SOME CHARACTERISTICS OF THE GLACIATED AREA OF NORTHEASTERN KANSAS.

BY ROBERT HAY, F. G. S. A.

Northeastern Kansas, from the Missouri river to west of the Little Blue river, and as far south as the mouth of the Big Blue and the Wakarusa, had a share in the glacial submergence that affected all the northeastern and north-central part of the North American continent. The theory of this ice age is, that, from some change in the earth's axis, the precession of the equinoxes, or one or both of these, combined with diminished solar influence, due to the attainment of the maximum eccentricity of the earth's orbit, or other cosmical or terrestrial changes, producing increased length of winter in the northern hemishere, the arctic conditions now fully represented in Greenland were expanded southerly, a great sheet of ice covering the continent as far south as the 39th parallel and as far west in Dakota as the 100th meridian. The change from this glacial climate to the modern conditions of the temperate zone was effected by opposite cosmical or terrestrial conditions, and the ice sheet melting on its southern edge retreated northward with halting steps or rapid progress, according to the strength or feebleness of the operating forces.

There are certain deposits in the region which seem to have been formed under the ice, others that were formed of material that was on and in the ice and laid down in streaks and patches as the ice melted, and others, yet again, deposited in the cold waters—lakes or streams—that fronted the ice sheet both in its extension and retreat. Since the disappearance of the ice sheet, vegetation has formed the black soil over the whole region. In Iowa, Michigan, and elsewhere, the finding of black soil and semifossilized wood *below* subglacial deposits, and *above* other deposits as certainly formed in the ice period, has indicated to the observers that the whole time of the glacial period was divided into two, or that there was an interglacial time, in which the ice retreated and that vegetation flourished, and the ice again advanced to about its former southern limit. In most of the ice region of the Mississippi valley, the southern border of the newer ice is about coincident with that of the first advance of the ice sheet, and the phenomena of the older glacial period are only to be examined where drainage or well sinkers have cut below the bog and soils that indicate the middle period of milder climate. Whether the first retreat of the ice was only temporary or extended through a long period, is not yet positively determined among glacialists.

It seems certain, however, that the second advance of the ice did not overspread northeastern Kansas. Remembering that the ice retreated northward, it goes without saying that the glacial phenomena will be newer as we go in that direction from the southern border of the glaciated area, and if the retreat of the ice were very slow, the southern parts would have had a much longer time to be exposed to the weathering and denuding agencies of post-glacial time. Northeastern Kansas has an older surface far away than parts of Iowa, and topographical character is no longer of a glaciated type, as in the Dakotas.

One of the usual signs of glacial action is the presence of striæ, grooves in and planing of the surface of the bed rock, done by the ice and the hard pebbles and bowlders contained in it. This phenomenon is largely missing in Kansas.

Prof. L. C. Wooster, in a short article in a recent number of the *American Geologist*, records the finding of a striated area in Nemaha county. One or two local observers have known of these marks for many years, but it is only this summer that they have been definitely recognized. They have been seen by Professors Woos-

ter, R. Hay, S. W. Williston, and G. H. Failyer, so that this Academy is pretty sure of their existence. The writer has, since then, examined an area in northern Pottawatomie county, as well situate for expecting striæ as the one in Nemaha: a north and south ridge, with bowlders of greenstone and quartzite scattered over both east and west flanks, and a hard limestone under a thin surface soil; the bottom of the soil undoubted glacial hardpan, four to eight inches thick, with pebbles in its paste. I uncovered some 20 square yards, but not a sign of striæ. Why? Because the limestone, which weathers in layers of an inch or two in thickness, had, under the action of the moisture, the carbonic acid, iron, etc., influencing its upper layer, become amalgamated with the hardpan, being soft, pasty, and ferruginous. In places this condition had penetrated to second and third layers of the stone. There were no striæ there because time has been an important factor. In samples of the striæ of Nemaha county, similar causes have begun to act in the direction of obliteration. Grooves haye become channels for nature's operations, and their sides have begun to yield to the chemical agencies, and the character of the striæ is becoming obscured. It is, then, mainly due to the fact that the glacial operations in Kansas were made on the first part of the ice age that these characteristic striæ are few and poorly preserved in Kansas.

The phenomena we know as moraines should be recognized by their agglomerations of foreign bowlders. Most persons in northeast Kansas know of the existence of these bowlders — red quartzite, granite, hornblendic greenstone, etc.— but the order of their deposit is not plain. The writer, however, recognizes in three or four places where the deposit is clearly morainic: One west of the Little Blue, in Washington county, where the bowlders (not a very extensive deposit) rest on the Dakota sandstone; another 10 miles south of Topeka, on the Missouri Pacific railway, where the bowlders are strung out north and south for more than a mile; a third is west by south from Lawrence, where a long ridge from east to west marks where the glacier rested and dropped on its southern edge this heavy body of transported bowlders. It is manifestly the terminal moraine, but it is covered with loess and soil, and only on its southern side, in a few shallow ravines, is its true character seen. It was first shown to the writer by our late friend, Joseph Savage. Again, the ice seems to have rested its weather edge on the bluffs of the Kaw valley, west of Wamego. The bluffs rise precipitously, and on their precipitous front a single bowlder in more than a mile is all that tells of the ice; but once on the top, the soil is full of them, large and small, some just revealing a polished surface, some standing a foot or two high, many of them many tons in weight. Why only one bowlder on the south front? Because the erosion of the Kaw valley, which the glacier then dammed, has been going on so long, that much is carried away, and the later alluvia have covered the rest. The real southern limit of this moraine is seen in the bowlders on the bluffs of the south side of the Kaw valley, in Wabaunsee county.

Again, morainic material dammed the Kaw valley above Lawrence, and the remnant of it on the south side may be seen a few miles above the city, where the Santa Fé railway runs on a shelf of the moraine above the river.

Near Kansas City, the bluffs on both sides of the river are rocky and precipitous, with fillings of loess in preglacial ravines. But, between North Lawrence and North Topeka, most of the hills bounding the valley are rounded knolls of glacial material. This is true, also, near Rossville and St. Mary's. They are the weathered remains of kames or osars. In Washington county, there are series of these hills, where the decomposing granite falls to pieces with a touch.

It has fallen to the writer's lot, within the last three years, to make several visits to Iowa and the two Dakotas, spending, altogether, six or seven weeks in North Dakota alone. There the glacial phenomena are sharp, clear, and well defined. Lake

basins are numerous; the drainage has not been completed. It is quite recently that the glacier left there, as compared with Kansas. The Turtle mountains are, probably, the spot where the retreating glacier lingered longest. Its osars and kames seem like the ridges of gravel described as on and about the southern edge of the great Muir glacier, of Alaska. The phenomena are all new. In northeast Kansas, the glacial phenomena are old, very old. Great morainic deposits, in Brown, Leavenworth and Douglas counties, are hidden by vegetation, which has covered the largest bowlders, and the deposits of gravels and clays have been assorted and arranged, and hills have been rounded to the angle of conservation.

The loess which belongs to the newer ice age has overlapped parts of glaciated Kansas; but there is an older loess that in places is very distinct, and the newer and the older loess, in front of the retreating, ice-carried icebergs, great or small, which accounts for a few glacial, subangular bowlders that have been found many miles beyond the limits recognized above as those of the ice sheet.

THE VARIABLE CHEMICAL COMPOSITION OF PLANTS AT DIFFERENT SEASONS—ILLUSTRATED BY TARAXACUM DENS-LEONIS.

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It is perhaps a well-known fact that the soluble principles elaborated by plants at different times during their growth differ very greatly, not only in quantity but also markedly in quality. For example, the common persimmon contains during the summer and until about frost a large percentage of a peculiar kind of tannin, which becomes replaced about the time of frost by glucose, pectin, yellow coloring matter, etc. Early in the spring, dandelion root contains uncrystallizable sugar, which diminishes during the summer. In autumn, it abounds in that starchy principle common to many of the roots of the natural order Compositæ, known by the name of "inulin." Pectin is also present to a large extent. There is also a bitter principle found in taraxacum root, called taraxacin, which makes it so valuable as a medical agent. Finally, it contains a very small percentage of a peculiar acrid principle soluble in alcoholic solutions.

Some years ago the attention of pharmacologists was directed to the subject: "The proper time for collection of dandelion root." Reviewing the literature, I find many communications to the journals from the pens of very able men; but these authorities differ as to the proper season for its collection and preparation for medicinal use, and, so far as I am able to learn, it is now a somewhat unsettled question. Very different seasons of the year are now recommended as the proper time for gathering. One authority recommends the beginning of spring, even before blooming; another, July, August, and September; another, that it should be collected between September and February. It stands to reason that that season of the year in which the bitter principle, taraxacin, is most abundant is the best time for collecting and drying. It has therefore occurred to me that I might bring forward this subject anew, and at different seasons of the year make such analyses of the root as will show the proportion and total amount of the various principles contained in the plant, making special note of the most important principle, taraxacin.

As I have just begun a series of analyses of the same roots collected in May and September, neither of these being fully completed, I shall be able to report only a few results in connection with the subject. I may add, also, that as the exact